fx-82MS
fx-83MS
fx-85MS
fx-270MS
fx-300MS
fx-350MS
User's Guide

CASIO

http://world.casio.com/edu_e/
SA0109-A Printed in China
E CA 310120-1

Removing and Replacing the Calculator's Cover

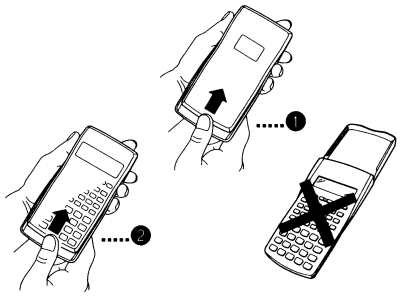
- **Before starting .....❶**

Holding the cover as shown in the illustration, slide the unit out of the cover.

- **After you are finished .....❷**

Holding the cover as shown in the illustration, slide the unit out of the cover.

- Always slide the keyboard end of the unit into the cover first. Never slide the display end of the unit into the cover.



Safety Precautions

Be sure to read the following safety precautions before using this calculator. Keep this manual handy for later reference.

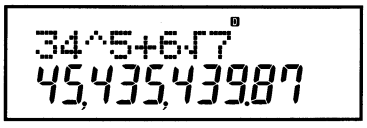
⚠ Caution

This symbol is used to indicate information that can result in personal injury or material damage if ignored.

Batteries

- After removing the battery from the calculator, put it in a safe place where it will not get into the hands of small children and accidentally swallowed.
- Keep batteries out of the reach of small children. If accidentally swallowed, consult with a physician immediately.
- Never charge batteries, try to take batteries apart, or allow batteries to become shorted. Never expose batteries to direct heat or dispose of them by incineration.
- Misuse of batteries can cause them to leak and damage nearby items, and can create the risk of fire and personal injury.
- **The battery that comes with this unit discharges slightly during shipment and storage. Because of this, it may require replacement sooner than the normal expected battery life.**
- **Low battery power can cause memory contents to become corrupted or lost completely. Always keep written records of all important data.**
- **Avoid use and storage in areas subjected to temperature extremes.**
  Very low temperatures can cause slow display response, total failure of the display, and shortening of battery life. Also avoid leaving the calculator in direct sunlight, near a window, near a heater or anywhere else it might be exposed to very high temperatures. Heat can cause discoloration or deformation of the calculator's case, and damage to internal circuitry.
- **Avoid use and storage in areas subjected to large amounts of humidity and dust.**
  Take care never to leave the calculator where it might be splashed by water or exposed to large amounts of humidity or dust. Such conditions can damage internal circuitry.
- **Never drop the calculator or otherwise subject it to strong impact.**
- **Never twist or bend the calculator.**
  Avoid carrying the calculator in the pocket of your trousers or other tight-fitting clothing where it might be subjected to twisting or bending.
- **Never try to take the calculator apart.**
- **Never press the keys of the calculator with a ballpoint pen or other pointed object.**
- **Use a soft, dry cloth to clean the exterior of the calculator.**
  If the calculator becomes very dirty, wipe it off with a cloth moistened in a weak solution of water and a mild neutral household detergent. Wring out all excess moisture before wiping the calculator. Never use thinner, benzene or other volatile agents to clean the calculator. Doing so can remove printed markings and can damage the case.

Two-line Display



The two-line display makes it possible to view both the calculation formula and its result at the same time.

- The upper line shows the calculation formula.
- The lower line shows the result.

A separator symbol is displayed every three digits when the integer part of the mantissa has more than three digits.

Before getting started...

■ Modes

Before starting a calculation, you must first enter the correct mode as indicated in the table below.

To perform this type of calculation:	Perform this key operation:	To enter this mode:
Basic arithmetic calculations	MODE 1	COMP
Standard deviation	MODE 2	SD
Regression calculations	MODE 3	REG

- Pressing the MODE key more than once displays additional setup screens. Setup screens are described in the sections of this manual where they are actually used to change the calculator setup.
- In this manual, the name of the mode you need to enter in order to perform the calculations being described is indicated in the main title of each section.

Example: Statistical Calculations SD REG

Note!

- To return the calculation mode and setup to the initial defaults shown below, press SHIFT CLR 2(Mode) =.

Calculation Mode:	COMP
Angle Unit:	Deg
Exponential Display Format:	Norm 1
Fraction Display Format:	a b/c
Decimal Point Character:	Dot

- Mode indicators appear in the upper part of the
- Be sure to check the current calculation mode (
COMP) and angle unit setting (Deg,
beginning a calculation.

■ Input Capacity

- Pressing AC does not clear Replay memory, so yo
recall the last calculation even after you press AC
- Replay memory capacity is 128 bytes for storage o
expressions and results.
- Replay memory is cleared by any of the followi
tions.
When you press the ON key
When you initialize modes and settings by pressi
CLR 2(Mode) =
When you change from one calculation mode to a
When you turn off the calculator.

■ Error Locator

- Pressing ▶ or ◀ after an error occurs displa
calculation with the cursor positioned at the lo
where the error occurred.

■ Multi-statements

A multi-statement is an expression that is made up
or more smaller expressions, which are joined using a
(:).

- **Example:** To add 2 + 3 and then multiply the resu

2 + 3 ALPHA : Ans × 4 =

2+3
Ans×4

■ Exponential Display Formats

This calculator can display up to 10 digits. Larger v
are automatically displayed using exponential notati
the case of decimal values, you can select betwee
formats that determine at what point exponential no
is used.

- To change the exponential display format, press th
key a number of times until you reach the expon
display format setup screen shown below.

Fix Sci Norm
1 2 3

- Press 3. On the format selection screen that app
press 1 to select Norm 1 or 2 for Norm 2.

• Norm 1

With Norm 1, exponential notation is automatically
for integer values with more than 10 digits and de
values with more than two decimal places.

• Norm 2

With Norm 2, exponential notation is automatically
for integer values with more than 10 digits and de
values with more than nine decimal places.

- All of the examples in this manual show calculatio
sults using the Norm 1 format.

■ Decimal Point and Separator Symb

You can use the display setup (Disp) screen to speci
symbols you want for the decimal point and 3-digit s
rator.

- To change the decimal point and separator symbo
ting, press the MODE key a number of times until you
the setup screen shown below.

Disp
1

- Display the selection screen.
1 ▶
- Press the number key (1 or 2) that correspo
the setting you want to use.
1(Dot): Period decimal point, comma sepa
2(Comma): Comma decimal point, period sepa

■ Initializing the Calculator

- Perform the following key operation when you w
initialize the calculation mode and setup, and cle
play memory and variables.
SHIFT CLR 3(All) =

Basic Calculations

■ Arithmetic Calculations

Use the MODE key to enter the COMP Mode when
want to perform basic calculations.
COMP .....

- Negative values inside of calculation
within parentheses.
sin −1.23 →
- It is not necessary to
parentheses.
sin 2.34 × 10^−5 →
ple 1: 3×(5×10

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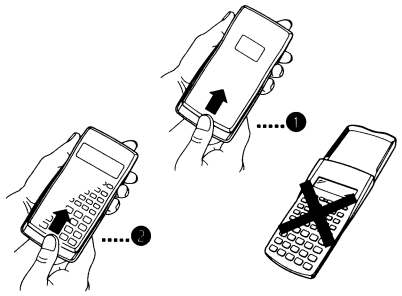

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- Keep batteries out of the reach of small children. If accidentally swallowed, consult with a physician immediately.
- Never charge batteries, try to take batteries apart, or allow batteries to become shorted. Never expose batteries to direct heat or dispose of them by incineration.
- Misuse of batteries can cause them to leak and damage nearby items, and can create the risk of fire and personal injury.
  - Always make sure that the battery's positive ⊕ and negative ⊖ ends are facing correctly when you load it into the calculator.
  - Remove the battery if you do not plan to use the calculator for a long time (fx-82MS/fx-83MS/fx-270MS/fx-350MS).
  - Use only the type of battery specified for this calculator in this manual.

Disposing of the Calculator

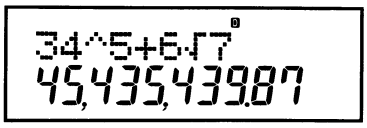
- Never dispose of the calculator by burning it. Doing so can cause certain components to suddenly burst, creating the risk of fire and personal injury.

- The displays and illustrations (such as key markings) shown in this User's Guide are for illustrative purposes only, and may differ somewhat from the actual items they represent.
- The contents of this manual are subject to change without notice.
- In no event shall CASIO Computer Co., Ltd. be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of the purchase or use of these materials. Moreover, CASIO Computer Co., Ltd. shall not be liable for any claim of any kind whatsoever against the use of these materials by any other party.

Handling Precautions

- **Be sure to press the [ON] key before using the calculator for the first time.**
- **Even if the calculator is operating normally, replace the battery at least once every three years for the fx-83MS/fx-85MS/fx-270MS/fx-300MS/fx-350MS, or at least once every two years for the fx-82MS.**
  A dead battery can leak, causing damage to and malfunction of the calculator. Never leave a dead battery in the calculator.

Two-line Display



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Before getting started...

■ Modes

Before starting a calculation, you must first enter the correct mode as indicated in the table below.

To perform this type of calculation:	Perform this key operation:	To enter this mode:
Basic arithmetic calculations	[MODE] [1]	COMP
Standard deviation	[MODE] [2]	SD
Regression calculations	[MODE] [3]	REG

- Pressing the [MODE] key more than once displays additional setup screens. Setup screens are described in the sections of this manual where they are actually used to change the calculator setup.
- In this manual, the name of the mode you need to enter in order to perform the calculations being described is indicated in the main title of each section.

Example: Statistical Calculations (SD / REG)

Note!

- To return the calculation mode and setup to the initial defaults shown below, press [SHIFT] [CLR] [2](Mode) [=].

Calculation Mode:	COMP
Angle Unit:	Deg
Exponential Display Format:	Norm 1
Fraction Display Format:	a b/c
Decimal Point Character:	Dot

- Mode indicators appear in the upper part of the display.
- Be sure to check the current calculation mode (SD, REG, COMP) and angle unit setting (Deg, Rad, Gra) before beginning a calculation.

■ Input Capacity

- The memory area used for calculation input can hold 79 "steps." One step is taken up each time you press a number key or arithmetic operator key ([+], [−], [×], [÷]). A [SHIFT] or [ALPHA] key operation does not take up a step, so inputting [SHIFT] [√], for example, takes up only one step.
- You can input up to 79 steps for a single calculation. Whenever you input the 73rd step of any calculation, the cursor changes from "_" to "■" to let you know memory is running low. If you need to input more than 79 steps, you should divide your calculation into two or more parts.
- Pressing the [Ans] key recalls the last result obtained, which you can use in a subsequent calculation. See "Answer Memory" for more information about using the [Ans] key.

■ Making Corrections During Input

- Use [◀] and [▶] to move the cursor to the location you want.
- Press [DEL] to delete the number or function at the current cursor position.
- Press [SHIFT] [INS] to change to an insert cursor [ ]. Inputting something while the insert cursor is on the display inserts the input at the insert cursor position.
- Pressing [SHIFT] [INS], or [=] returns to the normal cursor from the insert cursor.

■ Replay Function

- Every time you perform a calculation, the Replay Function stores the calculation formula and its result in replay memory. Pressing the [▲] key displays the formula and result of the calculation you last performed. Pressing [▲] again back steps sequentially (new-to-old) through past calculations.
- Pressing the [◀] or [▶] key while a replay memory calculation is on the display changes to the editing screen.
- Pressing the [◀] or [▶] key immediately after you finish a calculation displays the editing screen for that calculation.

- Press [3]. On the format selection screen that press [1] to select Norm 1 or [2] for Norm 2.

• Norm 1

With Norm 1, exponential notation is automati for integer values with more than 10 digits ar values with more than two decimal places.

• Norm 2

With Norm 2, exponential notation is automa for integer values with more than 10 digits a values with more than nine decimal places.

- All of the examples in this manual show re sults using the Norm 1 format.

■ Decimal Point and Separator

You can use the display setup (Disp) screen symbols you want for the decimal point and rator.

- To change the decimal point and sep ting, press the [MODE] key a number of tim the setup screen shown below.

Disp
1

- Display the selection screen. [1] [▶]
- Press the number key ([1] or [2]) that co the setting you want to use.

[1](Dot): Period decimal point, comm
[2](Comma): Comma decimal point, perio

■ Initializing the Calculator

- Perform the following key operation when y initialize the calculation mode and setup, an play memory and variables.

[SHIFT] [CLR] [3](All) [=]

Basic Calculations

■ Arithmetic Calculations

Use the [MODE] key to enter the COMP Mode wh want to perform basic calculations.

COMP .....

- Negative values inside of calculations must be within parentheses.

sin −1.23 → [sin] [(] [(−)] 1.23 [)]

- It is not necessary to enclose a negative expon parentheses.

sin 2.34 × 10^{-5} → [sin] 2.34 [EXP] [(−)] 5

- **Example 1:** 3×(5×10^{-9}) = ***1.5×10⁻⁸***

3 [×] 5 [EXP]

- **Example 2:** 5×(9+7) = ***80*** 5 [×] [(] 9 [+]
- You can skip all [)] operations before [=].

■ Fraction Operations

• Fraction Calculations

- Values are displayed in decimal format aut whenever the total number of digits of a fracti (integer + numerator + denominator + separa exceeds 10.

- **Example 1:** $\frac{2}{3}+\frac{1}{5}=\frac{13}{15}$

2 [a b/c] 3 [+] 1 [a b/c] 5 [=]

- **Example 2:** $3\frac{1}{4}+1\frac{2}{3}=4\frac{11}{12}$

3 [a b/c] 1 [a b/c] 4 [+]
1 [a b/c] 2 [a b/c] 3 [=] 4

- **Example 3:** $\frac{2}{4}=\frac{1}{2}$
- **Example 4:** $\frac{1}{2}+1.6=2.1$ 1 [a b/c] 2
- Results of calculations that mix fraction and de ues are always decimal.

• Decimal ↔ Fraction Conversion

- **Example 1:** $2.75=2\frac{3}{4}$ (Decimal → Fractio

2.75 [=]
[a b/c]
$= \frac{11}{4}$ [SHIFT] [d/c]

- **Example 2:** $\frac{1}{2}\leftrightarrow 0.5$ (Fraction ↔ D

1 [a b/c] 2

ressing AC does not clear Replay memory, so you can call the last calculation even after you press AC.
eplay memory capacity is 128 bytes for storage of both xpressions and results.
eplay memory is cleared by any of the following ac-ns.
hen you press the ON key
hen you initialize modes and settings by pressing SHIFT 2 (Mode) =
hen you change from one calculation mode to another
hen you turn off the calculator.

Error Locator

essing ▶ or ◀ after an error occurs displays the lculation with the cursor positioned at the location here the error occurred.

Multi-statements

ulti-statement is an expression that is made up of two ore smaller expressions, which are joined using a colon

xample: To add 2 + 3 and then multiply the result by 4

2 + 3 ALPHA : Ans × 4 =

2+3
5. Disp

=

Ans×4
20.

Exponential Display Formats

calculator can display up to 10 digits. Larger values automatically displayed using exponential notation. In case of decimal values, you can select between two ats that determine at what point exponential notation ed.

change the exponential display format, press the MODE y a number of times until you reach the exponential splay format setup screen shown below.

```
Fix Sci Norm
1   2   3
```

ess 3. On the format selection screen that appears, ess 1 to select Norm 1 or 2 for Norm 2.

orm 1

Norm 1, exponential notation is automatically used nteger values with more than 10 digits and decimal es with more than two decimal places.

orm 2

Norm 2, exponential notation is automatically used nteger values with more than 10 digits and decimal es with more than nine decimal places.

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Decimal Point and Separator Symbols

can use the display setup (Disp) screen to specify the ols you want for the decimal point and 3-digit sepa-.

change the decimal point and separator symbol set-g, press the MODE key a number of times until you reach setup screen shown below.

```
Disp
1
```

splay the selection screen.
▶
ess the number key (1 or 2) that corresponds to setting you want to use.

(Dot): Period decimal point, comma separator
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CLR 3 (All) =

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OMP ..... MODE 1

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2.34 × 10^{-5} → 2.34 EXP (−) 5

ample 1: 3×(5×10^{-9}) = ***1.5×10⁻⁸***

3 × 5 EXP (−) 9 =

a% | 0.5

a% | 1⌟2.

•Mixed Fraction ↔ Improper Fraction Conversion

- **Example:** $1\frac{2}{3} \leftrightarrow \frac{5}{3}$

1 a% 2 a% 3 = | 1⌟2⌟3.

SHIFT d/c | 5⌟3.

SHIFT d/c | 1⌟2⌟3.

- You can use the display setup (Disp) screen to specify the display format when a fraction calculation result is greater than one.
- To change the fraction display format, press the MODE key a number of times until you reach the setup screen shown below.

```
Disp
1
```

- Display the selection screen.
  1
- Press the number key (1 or 2) that corresponds to the setting you want to use.
  1 (a b/c): Mixed fraction
  2 (d/c): Improper fraction
- An error occurs if you try to input a mixed fraction while the d/c display format is selected.

■ Percentage Calculations

- **Example 1:** To calculate 12% of 1500 ***(180)***

1500 × 12 SHIFT %

- **Example 2:** To calculate what percentage of 880 is 660 ***(75%)***

660 ÷ 880 SHIFT %

- **Example 3:** To add 15% onto 2500 ***(2875)***

2500 × 15 SHIFT % +

- **Example 4:** To discount 3500 by 25% ***(2625)***

3500 × 25 SHIFT % −

- **Example 5:** If 300 grams are added to a test sample originally weighing 500 grams, what is the percentage increase in weight? ***(160%)***

300 + 500 SHIFT %

- **Example 6:** What is the percentage rise when temperature goes from 40°C to 46°C? How about to 48°C? ***(15%, 20%)***

46 − 40 SHIFT %

◀ ◀ ◀ ◀ ◀ ◀ 8 =

■ Degrees, Minutes, Seconds Calculations

- You can perform sexagesimal calculations using degrees (hours), minutes, and seconds, and convert between sexagesimal and decimal values.
- **Example 1:** To convert the decimal value 2.258 to a sexagesimal value and then back to a decimal value

2.258 = | 2.258

SHIFT ,,, | 2°15°28.8

,,, | 2.258

- **Example 2:** To perform the following calculation: 12°34'56" × 3.45

12 ,,, 34 ,,, 56 ,,, × 3.45 = | 43°24°31.2

■ FIX, SCI, RND

- To change the settings for the number of decimal places, the number of significant digits, or the exponential display format, press the MODE key a number of times until you reach the setup screen shown below.

```
Fix Sci Norm
1   2   3
```

- Press the number key (1, 2, or 3) that corresponds to the setup item you want to change.
  1 (Fix): Number of decimal places
  2 (Sci): Number of significant digits
  3 (Norm): Exponential display format
- **Example 1:** 200 ÷ 7 × 14 =

200 ÷ 7 × 14 = | 400.

(Specifies three decimal places.) MODE ····· 1 (Fix) 3 | FIX 400.000

- You can recall Answer Memory contents by pressing Ans.
- Answer Memory can store up to 12 digits for the mantissa and two digits for the exponent.
- Answer Memory contents are not updated if the operation performed by any of the above key operations results in an error.

■ Consecutive Calculations

- A calculation result produced by pressing = can be used in the next calculation.
- The result of a calculation can also be used with a subsequent Type A function (x^2, x^3, x^{-1}, $x!$), +, −, ^(x^y), $\sqrt[x]{}$, ×, ÷, $_nP_r$, $_nC_r$ and ° ' ".

■ Independent Memory

- Values can be input directly into memory, added to memory, or subtracted from memory. Independent memory is convenient for calculating cumulative totals.
- Independent memory uses the same memory area as variable M.
- To clear independent memory (M), input 0 SHIFT STO M.
- **Example:**

23 + 9 = ***32***	23 + 9 SHIFT STO M
53 − 6 = ***47***	53 − 6 M+
−) 45 × 2 = ***90***	45 × 2 SHIFT M−
(Total) ***−11***	RCL M

■ Variables

- There are nine variables (A through F, M, X and Y), which can be used to store data, constants, results, and other values.
- Use the following operation to delete data assigned to a particular variable: 0 SHIFT STO A. This operation deletes the data assigned to variable A.
- Perform the following key operation when you want to clear the values assigned to all of the variables.
  SHIFT CLR 1 (Mcl) =
- **Example:** 193.2 ÷ 23 = ***8.4***
  193.2 ÷ 28 = ***6.9***

193.2 SHIFT STO A ÷ 23 =

ALPHA A ÷ 28 =

Scientific Function Calculations COMP

Use the MODE key to enter the COMP Mode when you want to perform basic arithmetic calculations.

COMP ..... MODE 1

- Certain types of calculations may take a long time to complete.
- Wait for the result to appear on the display before starting the next calculation.
- π = 3.14159265359

■ Trigonometric/Inverse Trigonometric Functions

- To change the default angle unit (degrees, radians, grads), press the MODE key a number of times until you reach the angle unit setup screen shown below.

```
Deg Rad Gra
1   2   3
```

- Press the number key (1, 2, or 3) that corresponds to the angle unit you want to use.

(90° = $\frac{\pi}{2}$ radians = 100 grads)

- **Example 1:** sin 63°52'41" = ***0.897859012***

MODE ····· 1 (Deg)

sin 63 ,,, 52 ,,, 41 ,,, =

- **Example 2:** cos $\left(\frac{\pi}{3}\text{ rad}\right)$ = ***0.5***

MODE ····· 2 (Rad)

cos (SHIFT π ÷ 3) =

- **Example 3:** $\cos^{-1}\frac{\sqrt{2}}{2}$ = ***0.25*** π (rad) $\left(=\frac{\pi}{4}\text{ (rad)}\right)$

MODE ····· 2 (Rad)

SHIFT cos (√ 2 ÷ 2) = Ans ÷ SHIFT π =

- **Example 4:** $\tan^{-1}$ 0.741 = ***36.53844577***°

MODE ····· 1 (Deg)

SHIFT tan 0.741 =

■ Hyperbolic/Inverse Hyperbolic Functions

- **Example 1:** sinh 3.6 = ***18.28545536*** hyp sin 3.6 =

Norm 1, exponential notation is automatically used nteger values with more than 10 digits and decimal es with more than two decimal places.

orm 2

n Norm 2, exponential notation is automatically used nteger values with more than 10 digits and decimal es with more than nine decimal places.

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```
Disp
1
```

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▶

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2.34×10^{-5} → sin 2.34 EXP (−) 5

ample 1: $3\times(5\times10^{-9}) = 1.5\times10^{-8}$

3 × 5 EXP (−) 9 =

ample 2: $5\times(9+7) = 80$ 5 × (9 + 7) =

u can skip all) operations before =.

Fraction Operations

action Calculations

lues are displayed in decimal format automatically henever the total number of digits of a fractional value teger + numerator + denominator + separator marks) ceeds 10.

ample 1: $\frac{2}{3}+\frac{1}{5}=\frac{13}{15}$

2 a b/c 3 + 1 a b/c 5 = 13⌟15.

ample 2: $3\frac{1}{4}+1\frac{2}{3}=4\frac{11}{12}$

3 a b/c 1 a b/c 4 +
1 a b/c 2 a b/c 3 = 4⌟11⌟12.

ample 3: $\frac{2}{4}=\frac{1}{2}$ 2 a b/c 4 =

ample 4: $\frac{1}{2}+1.6 = 2.1$ 1 a b/c 2 + 1.6 =

sults of calculations that mix fraction and decimal val-s are always decimal.

ecimal ↔ Fraction Conversion

ample 1: $2.75 = 2\frac{3}{4}$ (Decimal → Fraction)

2.75 = 2.75
a b/c 2⌟3⌟4.
= $\frac{11}{4}$ SHIFT d/c 11⌟4.

ample 2: $\frac{1}{2}$ ↔ 0.5 (Fraction ↔ Decimal)

1 a b/c 2 = 1⌟2.

(75%)

660 ÷ 880 SHIFT % 75.

- **Example 3:** To add 15% onto 2500 *(2875)*

  2500 × 15 SHIFT % + 2875.

- **Example 4:** To discount 3500 by 25% *(2625)*

  3500 × 25 SHIFT % − 2625.

- **Example 5:** If 300 grams are added to a test sample originally weighing 500 grams, what is the percentage increase in weight? *(160%)*

  300 + 500 SHIFT % 160.

- **Example 6:** What is the percentage rise when temperature goes from 40°C to 46°C? How about to 48°C? *(15%, 20%)*

  46 − 40 SHIFT % 15.
  ◀ ◀ ◀ ◀ ◀ ◀ 8 = 20.

■ Degrees, Minutes, Seconds Calculations

- You can perform sexagesimal calculations using degrees (hours), minutes, and seconds, and convert between sexagesimal and decimal values.
- **Example 1:** To convert the decimal value 2.258 to a sexagesimal value and then back to a decimal value

  2.258 = 2.258
  SHIFT ▶ 2°15°28.8
  ▶ 2.258

- **Example 2:** To perform the following calculation: 12°34'56" × 3.45

  12 ° ' " 34 ° ' " 56 ° ' " × 3.45 = 43°24°31.2

■ FIX, SCI, RND

- To change the settings for the number of decimal places, the number of significant digits, or the exponential display format, press the MODE key a number of times until you reach the setup screen shown below.

```
Fix Sci Norm
1   2   3
```

- Press the number key (1, 2, or 3) that corresponds to the setup item you want to change.

  1 (Fix): Number of decimal places
  2 (Sci): Number of significant digits
  3 (Norm): Exponential display format

- **Example 1:** 200 ÷ 7 × 14 =

  200 ÷ 7 × 14 = 400.

  (Specifies three decimal places.) MODE ····· 1(Fix) 3 → FIX 400.000

  (Internal calculation continues using 12 digits.) 200 ÷ 7 = 28.571
  × 14 = 400.000

  The following performs the same calculation using the specified number of decimal places.

  200 ÷ 7 = 28.571

  (Internal rounding) SHIFT Rnd 28.571

  × 14 = 399.994

- Press MODE ····· 3(Norm) 1 to clear the Fix specification.
- **Example 2:** 1 ÷ 3, displaying result with two significant digits (Sci 2)

  MODE ····· 2(Sci) 2 1 ÷ 3 = → SCI 3.3^{-01}

- Press MODE ····· 3(Norm) 1 to clear the Sci specification.

Memory Calculations COMP

Use the MODE key to enter the COMP Mode when you want to perform a calculation using memory.

COMP ..... MODE 1

■ Answer Memory

- Whenever you press = after inputting values or an expression, the calculated result automatically updates Answer Memory contents by storing the result.
- In addition to =, Answer Memory contents are also updated with result whenever you press SHIFT %, M+, SHIFT M−, or SHIFT STO followed by a letter (A through F, or M, X, or Y).

SHIFT CLR 1(Mcl) =

- **Example:** 193.2 ÷ 23 = *8.4*
  193.2 ÷ 28 = *6.9*

  193.2 SHIFT STO A ÷ 23 =
  ALPHA A ÷ 28 = 6.9

Scientific Function Calculations COMP

Use the MODE key to enter the COMP Mode when you want to perform basic arithmetic calculations.

COMP ..... MODE 1

- Certain types of calculations may take a long time to complete.
- Wait for the result to appear on the display before starting the next calculation.
- π = 3.14159265359

■ Trigonometric/Inverse Trigonometric Functions

- To change the default angle unit (degrees, radians, grads), press the MODE key a number of times until you reach the angle unit setup screen shown below.

```
Deg Rad Gra
1   2   3
```

- Press the number key (1, 2, or 3) that corresponds to the angle unit you want to use.

  (90° = $\frac{\pi}{2}$ radians = 100 grads)

- **Example 1:** sin 63°52'41" = *0.897859012*

  MODE ····· 1 (Deg)
  sin 63 ° ' " 52 ° ' " 41 ° ' " =

- **Example 2:** $\cos\left(\frac{\pi}{3}\text{ rad}\right) = 0.5$

  MODE ····· 2 (Rad)
  cos (SHIFT π ÷ 3) =

- **Example 3:** $\cos^{-1}\frac{\sqrt{2}}{2} = 0.25\,\pi\text{ (rad)}\left(=\frac{\pi}{4}\text{ (rad)}\right)$

  MODE ····· 2 (Rad)
  SHIFT cos^{-1} (√ 2 ÷ 2) = Ans ÷ SHIFT π =

- **Example 4:** $\tan^{-1}0.741 = 36.53844577°$

  MODE ····· 1 (Deg)
  SHIFT tan^{-1} 0.741 =

■ Hyperbolic/Inverse Hyperbolic Functions

- **Example 1:** sinh 3.6 = *18.28545536* hyp sin 3.6 =
- **Example 2:** $\sinh^{-1}30 = 4.094622224$

  hyp SHIFT sin^{-1} 30 =

■ Common and Natural Logarithms/ Antilogarithms

- **Example 1:** log 1.23 = *0.089905111* log 1.23 =
- **Example 2:** ln 90 (= $\log_e 90$) = *4.49980967*

  ln 90 =
  ln e = *1* ln ALPHA e =

- **Example 3:** $e^{10} = 22026.46579$ SHIFT e^x 10 =
- **Example 4:** $10^{1.5} = 31.6227766$ SHIFT 10^x 1.5 =
- **Example 5:** $2^4 = 16$ 2 ^ 4 =

■ Square Roots, Cube Roots, Roots, Squares, Cubes, Reciprocals, Factorials, Random Numbers, π, and Permutation/Combination

- **Example 1:** $\sqrt{2}+\sqrt{3}\times\sqrt{5} = 5.287196909$

  √ 2 + √ 3 × √ 5 =

- **Example 2:** $\sqrt[3]{5}+\sqrt[3]{-27} = -1.290024053$

  SHIFT $\sqrt[3]{}$ 5 + SHIFT $\sqrt[3]{}$ ((−) 27) =

- **Example 3:** $\sqrt[7]{123}\ (=123^{\frac{1}{7}}) = 1.988647795$

  7 SHIFT $\sqrt[3]{}$ 123 =

- **Example 4:** $123+30^2 = 1023$ 123 + 30 x^2 =
- **Example 5:** $12^3 = 1728$ 12 x^3 =
- **Example 6:** $\frac{1}{\frac{1}{3}-\frac{1}{4}} = 12$

  (1 ÷ (3 x^{-1} − 4 x^{-1}) x^{-1} =

- **Example 7:** 8! = ***40320*** 8 SHIFT $x!$ =
- **Example 8:** To generate a random number between 0.000 and 0.999

SHIFT Ran# = | 0.664 |

(The above value is a sample only. Results differ each time.)

- **Example 9:** 3π = ***9.424777961*** 3 SHIFT π =
- **Example 10:** To determine how many different 4-digit values can be produced using the numbers 1 through 7
  - Numbers cannot be duplicated within the same 4-digit value (1234 is allowed, but 1123 is not). ***(840)***

7 SHIFT nPr 4 =

- **Example 11:** To determine how many different 4-member groups can be organized in a group of 10 individuals ***(210)***

10 nCr 4 =

■ Angle Unit Conversion

- Press SHIFT DRG▶ to display the following menu.

D R G
1 2 3

- Pressing 1, 2, or 3 converts the displayed value to the corresponding angle unit.
- **Example:** To convert 4.25 radians to degrees

MODE ····· 1 (Deg)

4.25 SHIFT DRG▶ 2 (R) = | 4.25r
243.5070629 |

■ Coordinate Conversion (Pol (*x*, *y*), Rec (*r*, θ))

- Calculation results are automatically assigned to variables E and F.
- **Example 1:** To convert polar coordinates (r=2, θ=60°) to rectangular coordinates (x, y) (Deg)

x = ***1*** SHIFT Rec 2 , 60) =

y = ***1.732050808*** RCL F

- Press RCL E to display the value of x, or RCL F to display the value of y.
- **Example 2:** To convert rectangular coordinates (1, $\sqrt{3}$) to polar coordinates (r,θ) (Rad)

r = ***2*** Pol(1 , √ 3) =

θ = ***1.047197551*** RCL F

- Press RCL E to display the value of r, or RCL F to display the value of θ.

■ Engineering Notation Calculations

- **Example 1:** To convert 56,088 meters to kilometers

→ ***56.088 × 10³ (km)*** 56088 = ENG

- **Example 2:** To convert 0.08125 grams to milligrams

→ ***81.25 × 10⁻³ (mg)*** 0.08125 = ENG

Statistical Calculations SD REG

Standard Deviation SD

Use the MODE key to enter the SD Mode when you want to perform statistical calculations using standard deviation.

SD ..... MODE 2

- Always start data input with SHIFT CLR 1 (Scl) = to clear statistical memory.
- Input data using the key sequence shown below.
  <x-data> DT
- Input data is used to calculate values for n, Σx, Σx^2, $\bar{x}$, σ_n and σ_{n-1}, which you can recall using the key operations noted nearby.

To recall this type of value:	Perform this key operation:
Σx^2	SHIFT S-SUM 1
Σx	SHIFT S-SUM 2
n	SHIFT S-SUM 3
$\bar{x}$	SHIFT S-VAR 1
σ_n	SHIFT S-VAR 2
σ_{n-1}	SHIFT S-VAR 3

- **Example:** To calculate σ_{n-1}, σ_n, $\bar{x}$, n, Σx, and Σx^2 for the following data : 55, 54, 51, 55, 53, 53, 54, 52

In the SD Mode:

SHIFT CLR 1 (Scl) = (Stat clear)

55 DT | n= SD
1. |

Each time you press DT to register your input, the number of data ...

memory left for data storage. If this happens, press the = key to display the screen shown below.

Edit OFF ESC 1 2

Press 2 to exit data input without registering the value you just input.

Press 1 if you want to register the value you just input, without saving it in memory. If you do this, however, you will not be able to display or edit any of the data you have input.

- To delete data you have just input, press SHIFT CL.

Regression Calculations REG

Use the MODE key to enter the REG Mode when you want to perform statistical calculations using regression.

REG ..... MODE 3

- Entering the REG Mode displays screens like the ones shown below.

Lin Log Exp ▸ 1 2 3

▶ ↓ ↑ ◀

▸Pwr Inv Quad 1 2 3

- Press the number key (1, 2, or 3) that corresponds to the type of regression you want to use.

1 (Lin): Linear regression
2 (Log): Logarithmic regression
3 (Exp): Exponential regression
▶ 1 (Pwr): Power regression
▶ 2 (Inv): Inverse regression
▶ 3 (Quad): Quadratic regression

- Always start data input with SHIFT CLR 1 (Scl) = to clear statistical memory.
- Input data using the key sequence shown below.
  <x-data> , <y-data> DT
- The values produced by a regression calculation depend on the values input, and results can be recalled using the key operations shown in the table below.

To recall this type of value:	Perform this key operation:
Σx^2	SHIFT S-SUM 1
Σx	SHIFT S-SUM 2
n	SHIFT S-SUM 3
Σy^2	SHIFT S-SUM ▶ 1
Σy	SHIFT S-SUM ▶ 2
Σxy	SHIFT S-SUM ▶ 3
Σx^3	SHIFT S-SUM ▶ ▶ 1
Σx^2y	SHIFT S-SUM ▶ ▶ 2
Σx^4	SHIFT S-SUM ▶ ▶ 3
$\bar{x}$	SHIFT S-VAR 1
$x\sigma_n$	SHIFT S-VAR 2
$x\sigma_{n-1}$	SHIFT S-VAR 3
$\bar{y}$	SHIFT S-VAR ▶ 1
$y\sigma_n$	SHIFT S-VAR ▶ 2
$y\sigma_{n-1}$	SHIFT S-VAR ▶ 3
Regression coefficient A	SHIFT S-VAR ▶ ▶ 1
Regression coefficient B	SHIFT S-VAR ▶ ▶ 2
Regression calculation other than quadratic regression	
Correlation coefficient r	SHIFT S-VAR ▶ ▶ 3
$\hat{x}$	SHIFT S-VAR ▶ ▶ ▶ 1
$\hat{y}$	SHIFT S-VAR ▶ ▶ ▶ 2

- The following table shows the key operations you should use to recall results in the case of quadratic regression.

To recall this type of value:	Perform this key operation:
Regression coefficient C	SHIFT S-VAR ▶ ▶ 3
$\hat{x}_1$	SHIFT S-VAR ▶ ▶ ▶ 1
$\hat{x}_2$	SHIFT S-VAR ▶ ▶ ▶ 2
$\hat{y}$	SHIFT S-VAR ▶ ▶ ▶ 3

- The values in the above tables can be used inside of expressions the same way you use variables.

• Linear Regression

The regression formula for linear regression is: $y = A + Bx$.

- **Example:** Atmospheric Pressure vs. Temperature

Temperature	Atmospheric Pressure
10°C	1003 hPa
15°C	1005 hPa
20°C	1010 hPa
25°C	1011 hPa
30°C	1014 hPa

Perform linear regression to determine the regression formula terms and correlation coefficient for the data nearby. Next, use the regression formula to estimate atmospheric pressure at 18°C and temperature at 1000 hPa. Finally, calculate the coeffi-

Logarithmic Regression	$y = A + B \cdot \ln x$
Exponential Regression	$y = A \cdot e^{B \cdot x}$ ($\ln y = \ln A +$
Power Regression	$y = A \cdot x^B$ ($\ln y = \ln A + B$
Inverse Regression	$y = A + B \cdot 1/x$

• Quadratic Regression

- The regression formula for quadratic regression is $y = A + Bx + Cx^2$.
- **Example:**

x_i	y_i
29	1.6
50	23.5
74	38.0
103	46.4
118	48.0

Perform quadratic regression t
termine the regression formula
for the data nearby. Next, us
regression formula to estimat
values for $\hat{y}$ (estimated value of
x_i = 16 and $\hat{x}$ (estimated value
for y_i = 20.

In the REG Mode:

▶ 3 (Quad)

SHIFT CLR 1 (Scl) = (Stat clear)

29 , 1.6 DT 50 , 23.
74 , 38.0 DT 103 , 46.
118 , 48.

Regression Coefficient A = ***−35.59856934*** SHIFT S-VAR ▶ ▶ 1

Regression Coefficient B = ***1.495939413*** SHIFT S-VAR ▶ ▶ 2

Regression Coefficient C = ***−6.71629667 × 10⁻³*** SHIFT S-VAR ▶ ▶ 3

$\hat{y}$ when x_i is 16 = ***−13.38291067*** 16 SHIFT S-VAR ▶ ▶ ▶ 3

$\hat{x}_1$ when y_i is 20 = ***47.14556728*** 20 SHIFT S-VAR ▶ ▶ ▶ 1

$\hat{x}_2$ when y_i is 20 = ***175.5872105*** 20 SHIFT S-VAR ▶ ▶ ▶ 2

Data Input Precautions

- DT DT inputs the same data twice.
- You can also input multiple entries of the same
  using SHIFT ; . To input the data "20 and 30" five ti
  for example, press 20 , 30 SHIFT ; 5 DT.
- The above results can be obtained in any order, an
  necessarily that shown above.
- Precautions when editing data input for standard de
  tion also apply for regression calculations.

Technical Information

■ When you have a problem.....

If calculation results are not what you expect or if an e
occurs, perform the following steps.

1. Press SHIFT CLR 2 (Mode) = to initialize all modes settings.
2. Check the formula you are working with to confirm correct.
3. Enter the correct mode and try performing the calc tion again.

If the above steps do not correct the problem, press ON key. The calculator performs a self-check operation deletes all data stored in memory if any abnormalit detected. Make sure you always keep written copies o important data.

■ Error Messages

The calculator is locked up while an error message is the display. Press AC to clear the error, or press ◀ or to display the calculation and correct the problem. "Error Locator" for details.

Math ERROR

- **Causes**
  - Calculation result is outside the allowable calcula range.
  - An attempt to perform a function calculation usin value that exceeds the allowable input range.
  - An attempt to perform an illogical operation (divi by zero, etc.)
- **Action**
  - Check your input values and make sure they are within the allowable ranges. Pay special attention values in any memory areas you are using.

Stack ERROR

- **Cause**
  - The capacity of the numeric stack or operator sta exceeded.
- **Action**
  - Simplify the calculation. The numeric stack has 10 els and the operator stack has 24 levels.
  - Divide your calculation into two or more ...

Syntax ERROR

- **Cause**
  - An attempt to perfo...

garithmic Regression	$y = A + B \cdot \ln x$
ponential Regression	$y = A \cdot e^{B \cdot x}$ ($\ln y = \ln A + Bx$)
wer Regression	$y = A \cdot x^B$ ($\ln y = \ln A + B \ln x$)
erse Regression	$y = A + B \cdot 1/x$

uadratic Regression

e regression formula for quadratic regression is:
$= A + Bx + Cx^2$.

xample:

x_i	y_i
29	1.6
50	23.5
74	38.0
03	46.4
18	48.0

Perform quadratic regression to determine the regression formula terms for the data nearby. Next, use the regression formula to estimate the values for $\hat{y}$ (estimated value of y) for $x_i = 16$ and $\hat{x}$ (estimated value of x) for $y_i = 20$.

e REG Mode:

[3](Quad)
[CLR] [1](Scl) [=] (Stat clear)

29 [,] 1.6 [DT] 50 [,] 23.5 [DT]
74 [,] 38.0 [DT] 103 [,] 46.4 [DT]
118 [,] 48.0 [DT]

ssion Coefficient A = *−35.59856934* [SHIFT] [S-VAR] [▶] [▶] [1] [=]
ssion Coefficient B = *1.495939413* [SHIFT] [S-VAR] [▶] [▶] [2] [=]
ssion Coefficient C = $-6.71629667 \times 10^{-3}$ [SHIFT] [S-VAR] [▶] [▶] [3] [=]
n x_i is 16 = *−13.38291067* 16 [SHIFT] [S-VAR] [▶] [▶] [▶] [3] [=]
en y_i is 20 = *47.14556728* 20 [SHIFT] [S-VAR] [▶] [▶] [▶] [1] [=]
en y_i is 20 = *175.5872105* 20 [SHIFT] [S-VAR] [▶] [▶] [▶] [2] [=]

a Input Precautions

[DT] inputs the same data twice.
u can also input multiple entries of the same data ing [SHIFT] [;]. To input the data "20 and 30" five times, example, press 20 [,] 30 [SHIFT] [;] 5 [DT].
e above results can be obtained in any order, and not cessarily that shown above.
ecautions when editing data input for standard deviation also apply for regression calculations.

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When you have a problem.....

lculation results are not what you expect or if an error urs, perform the following steps.

ress [SHIFT] [CLR] [2](Mode) [=] to initialize all modes and ettings.
heck the formula you are working with to confirm it is orrect.
nter the correct mode and try performing the calculaon again.
e above steps do not correct the problem, press the ey. The calculator performs a self-check operation and tes all data stored in memory if any abnormality is cted. Make sure you always keep written copies of all rtant data.

Error Messages

calculator is locked up while an error message is on display. Press [AC] to clear the error, or press [◀] or [▶] splay the calculation and correct the problem. See r Locator" for details.

h ERROR

uses
Calculation result is outside the allowable calculation ange.
An attempt to perform a function calculation using a alue that exceeds the allowable input range.
An attempt to perform an illogical operation (division y zero, etc.)

tion
Check your input values and make sure they are all ithin the allowable ranges. Pay special attention to alues in any memory areas you are using.

ck ERROR

use
he capacity of the numeric stack or operator stack is xceeded.

tion
implify the calculation. The numeric stack has 10 levels and the operator stack has 24 levels.
ivide your calculation into two or more separate parts.

tax ERROR

use
n attempt to perform an illegal mathematical operaon.

- Other operations are performed from left to right.
- Operations enclosed in parentheses are performed first.

■ Stacks

This calculator uses memory areas, called "stacks," to temporarily store values (numeric stack) and commands (command stack) according to their precedence during calculations. The numeric stack has 10 levels and the command stack has 24 levels. A stack error (Stack ERROR) occurs whenever you try to perform a calculation that is so complex that the capacity of a stack is exceeded.

- **Example:**

$2 \times ((3 + 4 \times (5 + 4) \div 3) \div 5) + 8 =$

① ② ③ ④ ⑤
[1] [2] [3] [4] [5] [6] [7]

Numeric Stack

①	2
②	3
③	4
④	5
⑤	4
⋮	

Command Stack

[1]	×
[2]	(
[3]	(
[4]	+
[5]	×
[6]	(
[7]	+
⋮	

- Calculations are performed in sequence according to "Order of Operations." Commands and values are deleted from the stack as the calculation is performed.

■ Input Ranges

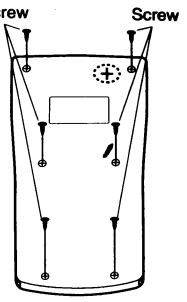
Internal digits: 12
Accuracy*: As a rule, accuracy is ±1 at the 10th digit.

Functions	Input Range	
$\sin x$	DEG	$0 \leqq \lvert x \rvert \leqq 4.499999999 \times 10^{10}$
	RAD	$0 \leqq \lvert x \rvert \leqq 785398163.3$
	GRA	$0 \leqq \lvert x \rvert \leqq 4.499999999 \times 10^{10}$
$\cos x$	DEG	$0 \leqq \lvert x \rvert \leqq 4.500000008 \times 10^{10}$
	RAD	$0 \leqq \lvert x \rvert \leqq 785398164.9$
	GRA	$0 \leqq \lvert x \rvert \leqq 5.000000009 \times 10^{10}$
$\tan x$	DEG	Same as $\sin x$, except when $\lvert x \rvert = (2n-1) \times 90$.
	RAD	Same as $\sin x$, except when $\lvert x \rvert = (2n-1) \times \pi/2$.
	GRA	Same as $\sin x$, except when $\lvert x \rvert = (2n-1) \times 100$.
$\sin^{-1} x$	$0 \leqq \lvert x \rvert \leqq 1$	
$\cos^{-1} x$		
$\tan^{-1} x$	$0 \leqq \lvert x \rvert \leqq 9.999999999 \times 10^{99}$	
$\sinh x$	$0 \leqq \lvert x \rvert \leqq 230.2585092$	
$\cosh x$		
$\sinh^{-1} x$	$0 \leqq \lvert x \rvert \leqq 4.999999999 \times 10^{99}$	
$\cosh^{-1} x$		
$\tanh x$	$0 \leqq \lvert x \rvert \leqq 9.999999999 \times 10^{-1}$	
$\tanh^{-1} x$		
$\log x / \ln x$	$0 < x$	
10^x	$-9.999999999 \times 10^{99} \leqq x \leqq 99.99999999$	
e^x	$-9.999999999 \times 10^{99} \leqq x \leqq 230.2585092$	
$\sqrt{x}$	$0 \leqq x < 1 \times 10^{100}$	
x^2	$\lvert x \rvert < 1 \times 10^{50}$	
$1/x$	$\lvert x \rvert < 1 \times 10^{100}; x \neq 0$	
$\sqrt[3]{x}$	$\lvert x \rvert < 1 \times 10^{100}$	
$x!$	$0 \leqq x \leqq 69$ (x is an integer)	
$n\mathrm{P}r$	$0 \leqq n \leqq 99$, $r \leqq n$ (n, r is an integer) $1 \leqq \{n!/(n-r)!\} \leqq 9.999999999 \times 10^{99}$	
$n\mathrm{C}r$	$0 \leqq n \leqq 99$, $r \leqq n$ (n, r is an integer)	
$\mathrm{Pol}(x, y)$	$\lvert x \rvert, \lvert y \rvert \leqq 9.999999999 \times 10^{49}$ $(x^2+y^2) \leqq 9.999999999 \times 10^{99}$	
$\mathrm{Rec}(r, \theta)$	$0 \leqq r \leqq 9.999999999 \times 10^{99}$ θ: Same as $\sin x$, $\cos x$	
°′″	$\lvert a \rvert, b, c < 1 \times 10^{100}$ $0 \leqq b, c$	
°′″	$\lvert x \rvert < 1 \times 10^{100}$ Decimal ↔ Sexagesimal Conversions $0°0'0'' \leqq \lvert x \rvert \leqq 999999°59'$	
$\wedge(x^y)$	$x>0$: $-1 \times 10^{100} < y \log x < 100$ $x=0$: $y>0$ $x<0$: $y=n$, $\frac{1}{2n+1}$ (n is an integer) However: $-1 \times 10^{100} < y \log \lvert x \rvert < 100$	
$\sqrt[x]{y}$	$y>0$: $x \neq 0$ $-1 \times 10^{100} < 1/x \log y < 100$ $y=0$: $x>0$	

• Replacing the Battery

Either of the following symptoms indicates battery power is low, and that the battery should be replaced.
- Display figures are dim and difficult to read in areas where there is little light available.
- Nothing appears on the display when you press the [ON] key.

• To replace the battery



① Remove the six screws that hold the back cover in place and then remove the back cover.
② Remove the old battery.
③ Wipe off the sides of new battery with a dry, soft cloth. Load it into the unit with the positive ⊕ side facing up (so you can see it).
④ Replace the back cover and secure it in place with the six screws.
⑤ Press [ON] to turn power on. Be sure not to skip this step.

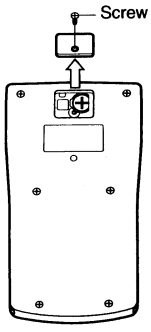
fx-83MS/fx-270MS/fx-350MS

This calculator is powered by single G13 Type (LR44) button battery.

• Replacing the Battery

Dim figures on the display of the calculator indicate that battery power is low. Continued use of the calculator when the battery is low can result in improper operation. Replace the battery as soon as possible when display figures become dim.

• To replace the battery



① Press [SHIFT] [OFF] to turn off power.
② Remove the screw that holds the battery cover in place and then remove the battery cover.
③ Remove the old battery.
④ Wipe off the sides of new battery with a dry, soft cloth. Load it into the unit with the positive ⊕ side facing up (so you can see it).
⑤ Replace the battery cover and secure it in place with the screw.
⑥ Press [ON] to turn power on.

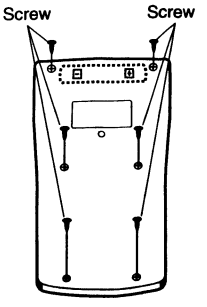
fx-82MS

This calculator is powered by a single AA-size battery.

• Replacing the Battery

Dim figures on the display of the calculator indicate that battery power is low. Continued use of the calculator when the battery is low can result in improper operation. Replace the battery as soon as possible when display figures become dim.

• To replace the battery



① Press [SHIFT] [OFF] to turn power off.
② Remove the six screws that hold the back cover in place and then remove the back cover.
③ Remove the old battery.
④ Load a new battery into the unit with its positive ⊕ and negative ⊖ ends facing correctly.
⑤ Replace the back cover and secure it in place with the six screws.
⑥ Press [ON] to turn power on.

Auto Power Off

Calculator power automatically turns off if you do not perform any operation for about six minutes. When this happens, press [ON] to turn power back on.

Specifications

Power Supply:
fx-82MS: AA-size battery (R6P (SUM-3))
fx-83MS/fx-270MS/fx-350MS: G13 Type button battery (LR44)
fx-82MS: and a single G13 Type button

$x = 1$ SHIFT Rec(2) 60) =

$y = 1.732050808$ RCL F

- Press RCL E to display the value of x, or RCL F to display the value of y.
- **Example 2:** To convert rectangular coordinates $(1, \sqrt{3})$ to polar coordinates (r, θ) (Rad)

$r = 2$ Pol(1 , √ 3) =

$\theta = 1.047197551$ RCL F

- Press RCL E to display the value of r, or RCL F to display the value of θ.

■ Engineering Notation Calculations

- **Example 1:** To convert 56,088 meters to kilometers

→ 56.088×10^3 (km) 56088 = ENG

- **Example 2:** To convert 0.08125 grams to milligrams

→ 81.25×10^{-3} (mg) 0.08125 = ENG

Statistical Calculations SD REG

Standard Deviation SD

Use the MODE key to enter the SD Mode when you want to perform statistical calculations using standard deviation.

SD ..... MODE 2

- Always start data input with SHIFT CLR 1 (Scl) = to clear statistical memory.
- Input data using the key sequence shown below.
  <x-data> DT
- Input data is used to calculate values for n, Σx, Σx^2, $\bar{x}$, σ_n and σ_{n-1}, which you can recall using the key operations noted nearby.

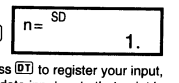
To recall this type of value:	Perform this key operation:
Σx^2	SHIFT S-SUM 1
Σx	SHIFT S-SUM 2
n	SHIFT S-SUM 3
$\bar{x}$	SHIFT S-VAR 1
σ_n	SHIFT S-VAR 2
σ_{n-1}	SHIFT S-VAR 3

Example: To calculate σ_{n-1}, σ_n, $\bar{x}$, n, Σx, and Σx^2 for the following data : 55, 54, 51, 55, 53, 53, 54, 52

In the SD Mode:

SHIFT CLR 1 (Scl) = (Stat clear)

55 DT



Each time you press DT to register your input, the number of data input up to that point is indicated on the display (n value).

54 DT 51 DT 55 DT
53 DT DT 54 DT 52 DT

ample Standard Deviation (σ_{n-1}) = **1.407885953** SHIFT S-VAR 3 =

opulation Standard Deviation (σ_n) = **1.316956719** SHIFT S-VAR 2 =

ithmetic Mean ($\bar{x}$) = **53.375** SHIFT S-VAR 1 =

umber of Data (n) = **8** SHIFT S-SUM 3 =

um of Values (Σx) = **427** SHIFT S-SUM 2 =

um of Squares of Values (Σx^2) = **22805** SHIFT S-SUM 1 =

ata Input Precautions

DT DT inputs the same data twice.

You can also input multiple entries of the same data using SHIFT ;. To input the data 110 ten times, for example, press 110 SHIFT ; 10 DT.

You can perform the above key operations in any order, and not necessarily that shown above.

While inputting data or after inputting data is complete, you can use the ▲ and ▼ keys to scroll through data you have input. If you input multiple entries of the same data using SHIFT ; to specify the data frequency (number of data items) as described above, scrolling through data shows both the data item and a separate screen for the data frequency (Freq).

ou can then edit the displayed data, if you want. Input the ew value and then press the = key to replace the old alue with the new one.

Pressing the DT key instead of = after changing a value on the display registers the value you input as a new data item, and leaves the old value as it is.

You can delete a data value displayed using ▲ and ▼ by pressing SHIFT CL. Deleting a data value causes all values following it to be shifted up.

Data values you register are normally stored in calculator memory. The message "Data Full" appears and you will not be able to input any more data if there is no statistical memory.

- Input data using the key sequence shown below.
  <x-data> , <y-data> DT
- The values produced by a regression calculation depend on the values input, and results can be recalled using the key operations shown in the table below.

To recall this type of value:	Perform this key operation:
Σx^2	SHIFT S-SUM 1
Σx	SHIFT S-SUM 2
n	SHIFT S-SUM 3
Σy^2	SHIFT S-SUM ▶ 1
Σy	SHIFT S-SUM ▶ 2
Σxy	SHIFT S-SUM ▶ 3
Σx^3	SHIFT S-SUM ▶ ▶ 1
$\Sigma x^2 y$	SHIFT S-SUM ▶ ▶ 2
Σx^4	SHIFT S-SUM ▶ ▶ 3
$\bar{x}$	SHIFT S-VAR 1
$x\sigma_n$	SHIFT S-VAR 2
$x\sigma_{n-1}$	SHIFT S-VAR 3
$\bar{y}$	SHIFT S-VAR ▶ 1
$y\sigma_n$	SHIFT S-VAR ▶ 2
$y\sigma_{n-1}$	SHIFT S-VAR ▶ 3
Regression coefficient A	SHIFT S-VAR ▶ ▶ 1
Regression coefficient B	SHIFT S-VAR ▶ ▶ 2
Regression calculation other than quadratic regression	
Correlation coefficient r	SHIFT S-VAR ▶ ▶ 3
$\hat{x}$	SHIFT S-VAR ▶ ▶ ▶ 1
$\hat{y}$	SHIFT S-VAR ▶ ▶ ▶ 2

- The following table shows the key operations you should use to recall results in the case of quadratic regression.

To recall this type of value:	Perform this key operation:
Regression coefficient C	SHIFT S-VAR ▶ ▶ 3
$\hat{x}_1$	SHIFT S-VAR ▶ ▶ ▶ 1
$\hat{x}_2$	SHIFT S-VAR ▶ ▶ ▶ 2
$\hat{y}$	SHIFT S-VAR ▶ ▶ ▶ 3

- The values in the above tables can be used inside of expressions the same way you use variables.

• Linear Regression

The regression formula for linear regression is: $y = A + Bx$.

- **Example:** Atmospheric Pressure vs. Temperature

Temperature	Atmospheric Pressure
10°C	1003 hPa
15°C	1005 hPa
20°C	1010 hPa
25°C	1011 hPa
30°C	1014 hPa

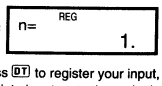
Perform linear regression to determine the regression formula terms and correlation coefficient for the data nearby. Next, use the regression formula to estimate atmospheric pressure at 18°C and temperature at 1000 hPa. Finally, calculate the coefficient of determination (r^2) and sample covariance $\left(\frac{\Sigma xy - n \cdot \bar{x} \cdot \bar{y}}{n-1}\right)$.

In the REG Mode:

1 (Lin)

SHIFT CLR 1 (Scl) = (Stat clear)

10 , 1003 DT



Each time you press DT to register your input, the number of data input up to that point is indicated on the display (n value).

15 , 1005 DT
20 , 1010 DT 25 , 1011 DT
30 , 1014 DT

Regression Coefficient A = **997.4** SHIFT S-VAR ▶ ▶ 1 =

Regression Coefficient B = **0.56** SHIFT S-VAR ▶ ▶ 2 =

Correlation Coefficient r = **0.982607368** SHIFT S-VAR ▶ ▶ 3 =

Atmospheric Pressure at 18°C = **1007.48**

18 SHIFT S-VAR ▶ ▶ ▶ 2 =

Temperature at 1000 hPa = **4.642857143**

1000 SHIFT S-VAR ▶ ▶ ▶ 1 =

Coefficient of Determination = **0.965517241**

SHIFT S-VAR ▶ ▶ 3 x^2 =

Sample Covariance = **35**

(SHIFT S-SUM ▶ 3 −
SHIFT S-SUM 3 × SHIFT S-VAR 1 ×
SHIFT S-VAR ▶ 1) ÷
(SHIFT S-SUM 3 − 1) =

• Logarithmic, Exponential, Power, and Inverse Regression

- Use the same key operations as linear regression to recall results for these types of regression.
- The following shows the regression formulas for each type of regression.

necessarily that shown above.

- Precautions when editing data input for standard deviation also apply for regression calculations.

Technical Information

■ When you have a problem.....

If calculation results are not what you expect or if an error occurs, perform the following steps.

1. Press SHIFT CLR 2 (Mode) = to initialize all modes and settings.
2. Check the formula you are working with to confirm it is correct.
3. Enter the correct mode and try performing the calculation again.

If the above steps do not correct the problem, press the ON key. The calculator performs a self-check operation and deletes all data stored in memory if any abnormality is detected. Make sure you always keep written copies of all important data.

■ Error Messages

The calculator is locked up while an error message is on the display. Press AC to clear the error, or press ◀ or ▶ to display the calculation and correct the problem. See "Error Locator" for details.

Math ERROR

- **Causes**
  - Calculation result is outside the allowable calculation range.
  - An attempt to perform a function calculation using a value that exceeds the allowable input range.
  - An attempt to perform an illogical operation (division by zero, etc.)
- **Action**
  - Check your input values and make sure they are all within the allowable ranges. Pay special attention to values in any memory areas you are using.

Stack ERROR

- **Cause**
  - The capacity of the numeric stack or operator stack is exceeded.
- **Action**
  - Simplify the calculation. The numeric stack has 10 levels and the operator stack has 24 levels.
  - Divide your calculation into two or more separate parts.

Syntax ERROR

- **Cause**
  - An attempt to perform an illegal mathematical operation.
- **Action**
  - Press ◀ or ▶ to display the calculation with the cursor located at the location of the error and make required corrections.

Arg ERROR

- **Cause**
  - Improper use of an argument
- **Action**
  - Press ◀ or ▶ to display the location of the cause of the error and make required corrections.

■ Order of Operations

Calculations are performed in the following order of precedence.

① Coordinate transformation: Pol (x, y), Rec (r, θ)
② Type A functions:
With these functions, the value is entered and then the function key is pressed.
x^3, x^2, x^{-1}, $x!$, ° ' "
$\hat{x}$, $\hat{x}_1$, $\hat{x}_2$, $\hat{y}$
Angle unit conversions
③ Powers and roots: $\wedge(x^y)$, $\sqrt[x]{\ }$
④ $a^b/_c$
⑤ Abbreviated multiplication format in front of π, memory name, or variable name: 2π, 5A, πA, etc.
⑥ Type B functions:
With these functions, the function key is pressed and then the value is entered.
$\sqrt{\ }$, $\sqrt[3]{\ }$, log, ln, e^x, 10^x, sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$
⑦ Abbreviated multiplication format in front of functions: $2\sqrt{3}$, Alog2, etc.
⑧ Permutation and combination: nPr, nCr
⑨ ×, ÷
⑩ +, −

- Operations of the same precedence are performed right to left. $e^x\ln\sqrt{\ }120 \rightarrow e^x\{\ln(\sqrt{\ }120$

Technical Information

When you have a problem.....

calculation results are not what you expect or if an error curs, perform the following steps.

Press [SHIFT] [CLR] [2](Mode) [=] to initialize all modes and settings.
Check the formula you are working with to confirm it is correct.
Enter the correct mode and try performing the calculation again.

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Error Messages

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Causes
Calculation result is outside the allowable calculation range.
An attempt to perform a function calculation using a value that exceeds the allowable input range.
An attempt to perform an illogical operation (division by zero, etc.)

Action
Check your input values and make sure they are all within the allowable ranges. Pay special attention to values in any memory areas you are using.

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Cause
The capacity of the numeric stack or operator stack is exceeded.

Action
Simplify the calculation. The numeric stack has 10 levels and the operator stack has 24 levels.
Divide your calculation into two or more separate parts.

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Cause
An attempt to perform an illegal mathematical operation.

Action
Press [◀] or [▶] to display the calculation with the cursor located at the location of the error and make required corrections.

g ERROR

Cause
mproper use of an argument

Action
Press [◀] or [▶] to display the location of the cause of he error and make required corrections.

Order of Operations

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Coordinate transformation: Pol (x, y), Rec (r, θ)
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bbreviated multiplication format in front of Type B functions: $2\sqrt{3}$, Alog2, etc.
ermutation and combination: nPr, nCr
×, ÷
+, −
perations of the same precedence are performed from ht to left. $e^x\ln\sqrt{\ }120 \rightarrow e^x\{\ln(\sqrt{\ }120)\}$

	RAD	$0 \leqq \lvert x \rvert \leqq 785398163.3$
	GRA	$0 \leqq \lvert x \rvert \leqq 4.499999999\times10^{10}$
$\cos x$	DEG	$0 \leqq \lvert x \rvert \leqq 4.500000008\times10^{10}$
	RAD	$0 \leqq \lvert x \rvert \leqq 785398164.9$
	GRA	$0 \leqq \lvert x \rvert \leqq 5.000000009\times10^{10}$
$\tan x$	DEG	Same as $\sin x$, except when $\lvert x \rvert = (2n-1)\times90$.
	RAD	Same as $\sin x$, except when $\lvert x \rvert = (2n-1)\times\pi/2$.
	GRA	Same as $\sin x$, except when $\lvert x \rvert = (2n-1)\times100$.
$\sin^{-1}x$ $\cos^{-1}x$		$0 \leqq \lvert x \rvert \leqq 1$
$\tan^{-1}x$		$0 \leqq \lvert x \rvert \leqq 9.999999999\times10^{99}$
$\sinh x$ $\cosh x$		$0 \leqq \lvert x \rvert \leqq 230.2585092$
$\sinh^{-1}x$ $\cosh^{-1}x$		$0 \leqq \lvert x \rvert \leqq 4.999999999\times10^{99}$
$\tanh x$ $\tanh^{-1}x$		$0 \leqq \lvert x \rvert \leqq 9.999999999\times10^{-1}$
$\log x$/$\ln x$		$0 < x$
10^x		$-9.999999999\times10^{99} \leqq x \leqq 99.99999999$
e^x		$-9.999999999\times10^{99} \leqq x \leqq 230.2585092$
$\sqrt{x}$		$0 \leqq x < 1\times10^{100}$
x^2		$\lvert x \rvert < 1\times10^{50}$
$1/x$		$\lvert x \rvert < 1\times10^{100};\ x \neq 0$
$\sqrt[3]{x}$		$\lvert x \rvert < 1\times10^{100}$
$x!$		$0 \leqq x \leqq 69$ (x is an integer)
nPr		$0 \leqq n \leqq 99$, $r \leqq n$ (n, r is an integer) $1 \leqq \{n!/(n-r)!\} \leqq 9.999999999\times10^{99}$
nCr		$0 \leqq n \leqq 99$, $r \leqq n$ (n, r is an integer)
Pol(x, y)		$\lvert x \rvert$, $\lvert y \rvert \leqq 9.999999999\times10^{49}$ $(x^2+y^2) \leqq 9.999999999\times10^{99}$
Rec(r, θ)		$0 \leqq r \leqq 9.999999999\times10^{99}$ θ: Same as $\sin x$, $\cos x$
° ′ ″		$\lvert a \rvert$, b, $c < 1\times10^{100}$ $0 \leq b$, c
$\overleftarrow{\text{° ′ ″}}$		$\lvert x \rvert < 1\times10^{100}$ Decimal ↔ Sexagesimal Conversions $0°0°0'' \leqq \lvert x \rvert \leqq 999999°59°$
$\wedge(x^y)$		$x>0$: $-1\times10^{100} < y\log x < 100$ $x=0$: $y>0$ $x<0$: $y=n$, $\frac{1}{2n+1}$ (n is an integer) However: $-1\times10^{100} < y\log\lvert x \rvert < 100$
$\sqrt[x]{y}$		$y>0$: $x \neq 0$ $-1\times10^{100} < 1/x\ \log y < 100$ $y=0$: $x>0$ $y<0$: $x=2n+1$, $\frac{1}{n}$ ($n \neq 0$; n is an integer) However: $-1\times10^{100} < 1/x\log\lvert y \rvert < 100$
$a^b/_c$		Total of integer, numerator, and denominator must be 10 digits or less (including division marks).
SD (REG)		$\lvert x \rvert < 1\times10^{50}$ $\lvert y \rvert < 1\times10^{50}$ $\lvert n \rvert < 1\times10^{100}$ $x\sigma_n$, $y\sigma_n$, $\bar{x}$, $\bar{y}$ A, B, r : $n \neq 0$ $x\sigma_{n-1}$, $y\sigma_{n-1}$: $n \neq 0, 1$

* For a single calculation, calculation error is ±1 at the 10th digit. (In the case of exponential display, calculation error is ±1 at the last significant digit.) Errors are cumulative in the case of consecutive calculations, which can also cause them to become large. (This is also true of internal consecutive calculations that are performed in the case of $\wedge(x^y)$, $\sqrt[x]{y}$, $x!$, $\sqrt[3]{\ }$, nPr, nCr, etc.)
In the vicinity of a function's singular point and point of inflection, errors are cumulative and may become large.

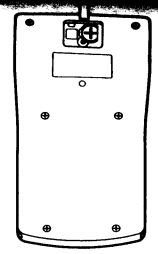
Power Supply

The type of battery you should use depends on the model number of your calculator.

fx-85MS/fx-300MS

The TWO WAY POWER system actually has two power supplies: a solar cell and a G13 Type (LR44) button battery. Normally, calculators equipped with a solar cell alone can operate only when relatively bright light is present. The TWO WAY POWER system, however, lets you continue to use the calculator as long as there is enough light to read the display.

then remove the battery cover.



③ Remove the old battery.
④ Wipe off the sides of new battery with a dry, soft cloth. Load it into the unit with the positive ⊕ side facing up (so you can see it).
⑤ Replace the battery cover and secure it in place with the screw.
⑥ Press [ON] to turn power on.

fx-82MS

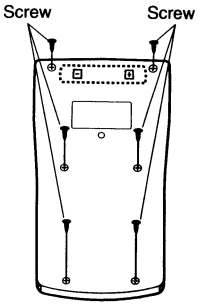
This calculator is powered by a single AA-size battery.

• Replacing the Battery

Dim figures on the display of the calculator indicate that battery power is low. Continued use of the calculator when the battery is low can result in improper operation. Replace the battery as soon as possible when display figures become dim.

• To replace the battery

① Press [SHIFT] [OFF] to turn power off.
② Remove the six screws that hold the back cover in place and then remove the back cover.
③ Remove the old battery.
④ Load a new battery into the unit with its positive ⊕ and negative ⊖ ends facing correctly.
⑤ Replace the back cover and secure it in place with the six screws.
⑥ Press [ON] to turn power on.



Auto Power Off

Calculator power automatically turns off if you do not perform any operation for about six minutes. When this happens, press [ON] to turn power back on.

Specifications

Power Supply:
fx-82MS: Single AA-size battery (R6P (SUM-3))
fx-83MS/fx-270MS/fx-350MS: Single G13 Type button battery (LR44)
fx-85MS/fx-300MS: Solar cell and a single G13 Type button battery (LR44)

Battery Life:
fx-82MS: Approximately 17,000 hours continuous display of flashing cursor. Approximately 2 years when left with power turned off.
fx-83MS/fx-270MS/fx-350MS: Approximately 9,000 hours continuous display of flashing cursor. Approximately 3 years when left with power turned off.
fx-85MS/fx-300MS: Approximately 3 years (1 hour use per day).

Dimensions:
fx-82MS: 18.6 (H) × 85 (W) × 156 (D) mm
¾″ (H) × 3⅜″ (W) × 6⅛″ (D)
fx-83MS/fx-85MS/fx-270MS/fx-300MS/fx-350MS: 12.2 (H) × 85 (W) × 155 (D) mm
½″ (H) × 3⅜″ (W) × 6⅛″ (D)

Weight:
fx-82MS: 125 g (4.4 oz) including battery
fx-83MS/fx-85MS/fx-270MS/fx-300MS/fx-350MS: 100 g (3.5 oz) including battery

Power Consumption: 0.0002 W

Operating Temperature: 0°C to 40°C (32°F to 104°F)

CE
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